1,000 to 3,000 Capacity Brick Kiln
Technical Bulletin No. 12

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CAPACITY BRICK KILN

PAPUA NEW GUINEA
DEPARTMENT OF PUBLIC WORKS
BUILDING RESEARCH STATION

TECHNICAL BULLETIN No. 12, DECEMBER, 1973.

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INTRODUCTION

A 1,000 to 3,000 capacity brick kiln has been devised by the Building Research Station, to meet the needs of small scale intermittent production of a durable material at village level.

The design has been made as simple as possible, eliminating the need for skilled labour in its construction.

Technical Bulletin No. 7 "Selection of Materials for Burnt Clay Bricks", and Bulletin No. 11 "Manufacture of Clay Bricks" should be read in conjunction with this Bulletin.

This Bulletin was compiled by,

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GLOSSARY OF TERMS

A WICKET is an opening in one of the end walls through which the bricks are loaded and unloaded. This opening is filled with dry layed bricks and dismantled when the kiln has to be unloaded.

A CORBELL is a brick projecting past the vertical line of the brick beneath.

DRY LAYING is placing bricks on top and in line with each other without the use of mortar.

BOND is when the bricks are layed to a predetermined interlocking pattern.

BAGGING is done by wetting the brick wall with water and rubbing it with clay on a piece of hessian (sugar or copra sack) until all the crevices are filled.

MORTAR is a composition of sand / cement or sand / lime / cement mixed with water.

GREEN BRICKS are clay bricks which have been moulded but not burnt.

SEGAR CONES are a proprietary item made in the shape of a triangular cond from materials which are blanded to collapse at varying temperatures, this indicating the temperature of the kiln in that area. These cones are numbered when manufactured to indicate the temperature at which they collapse.

BAG WALL is a small wall built across the fire box to control the flow of the fire

DESCRIPTION

The kiln is a rectangular construction with an internal dimension sufficient to stack to a predetermined pattern of a maximum of 3,000 bricks within its walls.

Openings are left on the long sides forming the opening to the firebox.

The walls which are three bricks thick are made of unburnt clay bricks and dry layed to the bond shown in Appendix "A". After laying the cracks are filled with clay internally and externally by bagging.

During the burn cracking will occur in the walls, these are filled with clay as they appear.

The bricks inside the kiln to be burnt are stacked in the manner shown in Appendix "C". the method of stacking, forms fireboxes in which timber is burnt as fuel. Green bricks are also used to form a grate as shown in Appendix "D".

The top of the kiln is closed off by two layers of bricks close stacked and covered with soil.

At intervals along the walls, openings are formed which create a draft forcing the fire and hot air through the stacked bricks. these openings can be opened or closed to adjust the strength of the draft, according to prevailing conditions.

In areas subjected to heavy rain falls, it would be necessary to place some cover over the kiln. This could be constructed using bush timber and a corrugated iron roof, high enough not to be damaged by head radiating from the kiln.

If only 1,000 or 2,000 bricks are required, a dummy wall can be built inside and across the kiln blocking off one or two of the fire boxes.

CONSTRUCTION

Select a site which is level and not subject to flooding.

Set out the kiln in accordance with the plan, Appendix "B" by driving pegs into the ground in relation to the four corners. Check that the building is square by ensuring that both the diagonals are the same length.

It is not necessary to be as precise as if setting out for a house, but to make working easier it is desirable that the building is reasonably square and to the diamensions on the plan. If this is done no trouble will be encountered when the kiln is being loaded to the layout shown in Appendix "C" and "D".

Excavate to a depth of three inches the width of the walls plus an inch on either side, then fill with sand to a level of one inch below the ground level.

Dry lay the bricks on this surface to the bond shown in Appendix "A" and to the diamensions shown on the plan in Appendix "B". 3,400 bricks are required for the construction.

When dry laying it will be difficult to keep exactly to the bond shown in Appendix "A", but an effort should be made to keep to it within reason. This can be done by leaving small spaces between the bricks at intervals and filling them with clay at a later date.

At a height of four feet inspection opening are left in the centre between the fireboxes and in the centre of each end wall.

To close over the firebox, the bricks are corbelled over the openings to the bond shown in the elevation.

After all the bricks are layed to the height shown the kiln is bagged inside and out.

How straight the finished kiln will appear will depend on how square and straight the bricks were made originally. This will in no way effect the performance of the kiln, but may make construction more difficult.

As the bricks are dry layed the small space between each brick eliminates the requirement for a normal expansion joint.

LOADING

For easier and more economical handling, a brick barrow made to the plan in Appendix "E" is suggested.

Appendix "C" shows the loading of the kiln, which is started at the furtherest end of the kiln from the wicket.

Commence with the bag wall by laying a single brick (4½") wall along the centre line of the kiln, in close dry laid bricks. This will cut the three large fire boxes into six smaller ones.

As the kiln is loaded this wall continues along the kiln to the wicket and stops at a height of twelve courses, which will bring the top of the bag wall just above the top of the fire box.

Commencing with the back half of course one (1) and starting at the back of the kiln and from the bag wall lay the bricks on edge with three inch spacings. Then as shown place one run of course numbers 2, 3, 4, 5, 6 and 7 on top, with spacing between the bricks shown in the details, which is three inches or finger width of approximately one inch.

The brick grate as shown in Appendix "D" is then placed against course number 1 (NOTE 2 inch spacings are shown on the sides) then continue with the other run of courses from 1 to 7 on the opposite side of the grate, followed by course 8 which completes and covers the top of the firebox.

Continue loading the kiln with alternate courses 9 to 14 which completes the stacking. It should be noted that this stacking method has a spacing of finger thickness, which would be approximately one inch.

Courses 15 and 16 are placed close packed to close off the top of the kiln and form the roof. Leave bricks out between the fire boxes, along the sides and at the centre of each end and along the centre of the kiln over the fire boxes. These openings form the flues which can be opened or closed to control the fire.

As there are three openings on each side for the fire boxes, the procedure as described is repeated until the kiln is fully loaded.

Close the wicket with dry layed bricks and bag externally.

The top of the kiln is then covered with six inches of earth to help retain the heat.

FIRING

A slow fire is started in all the fire boxes with wood fuel. This can be off-cuts from a timber mill or bush timber whichever is available in the area. Some timbers give more heat when burnt than others, so this type would be preferable.

Care should be taken with initial firing, ensuring that only a light fire is used until the bricks are completely dried out.

When firing, the ash pit should be regularly cleaned out. The ash should be pulled to the outside front of the fire box to preheat the air passing into the fire.

Timber is placed on the fire as it burns down NOT after it has completely burnt out.

To check the temperature, Segar cones are placed amongst the stacked bricks where they can be seen through the pipes built into the wall. These pipes are plugged with clay when not being used to view the cones.

Initially to assist a small enterprise or an individual these cones would be supplied by the Research Station on application. This assistance would only be available to the applicant for his initial burn.

The temperature required and suitability of the material for a satisfactory brick, should have been obtained from the Research Station prior to commencing the venture.

The time to complete a burn of bricks will largely depend on how well the fire is tended and the quality of the timber used. If care is taken, four to five days should be expected.

When firing is completed, all openings to the kiln are sealed off with bricks and clay and the kiln allowed to gradually cool, until the bricks can be safely handled, this will take approximately three days.

UNLOADING

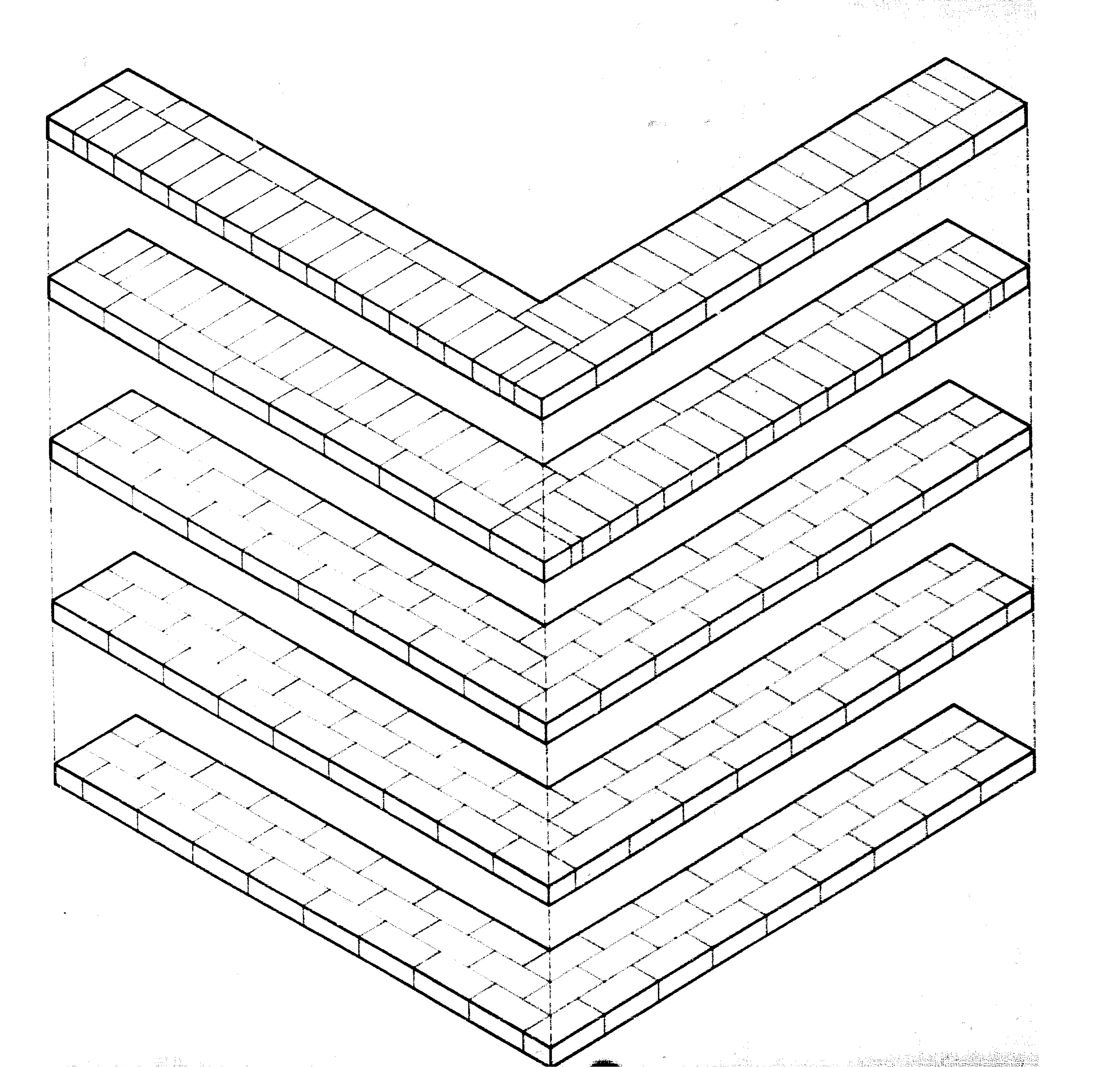
When the kiln has cooled enough and the bricks can be handled, the wicket is dismantled and the earth's removed from the roof.

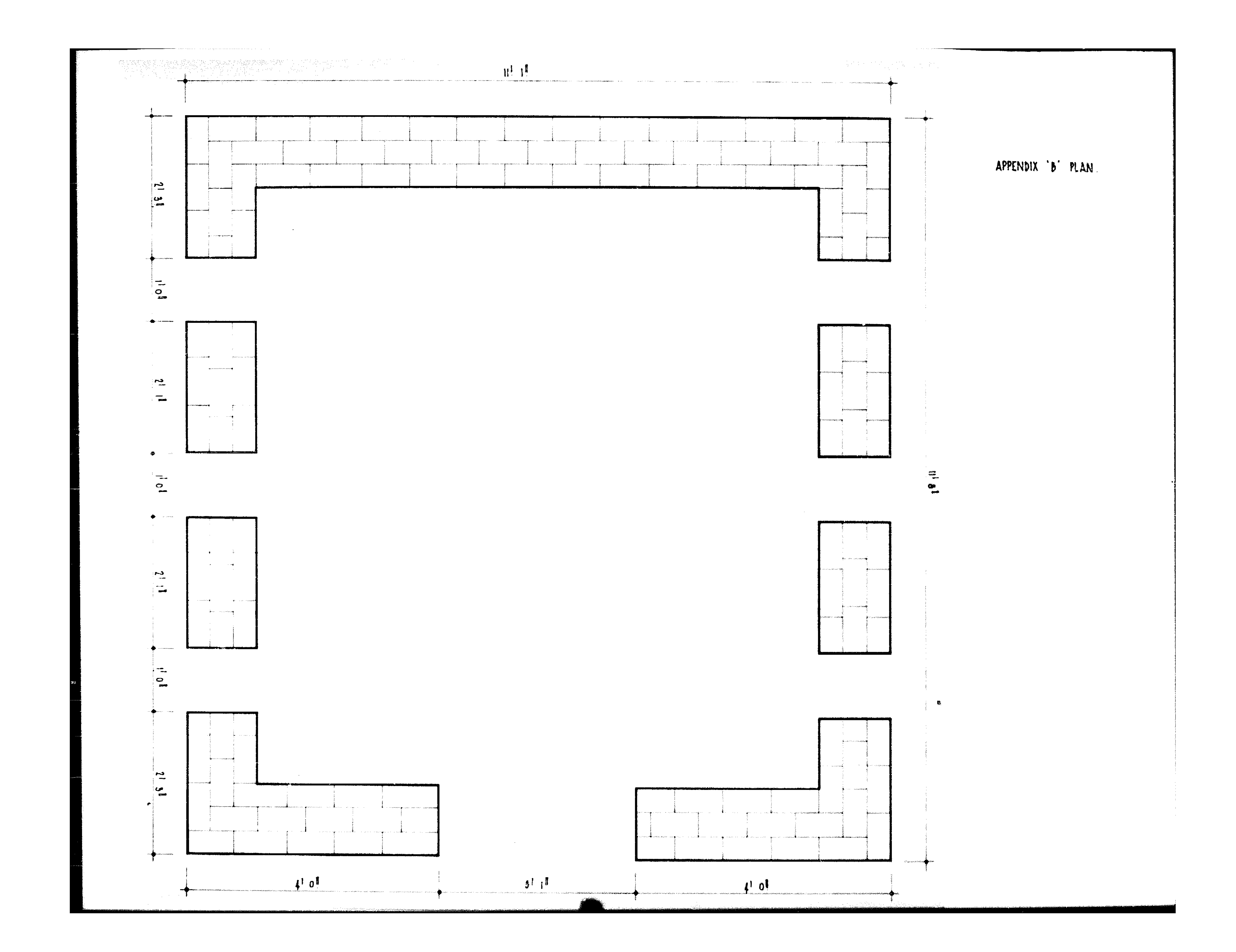
The bricks are then removed by barrow and stacked until required for a project.

Experience will enable the operator to differentiate between the unburnt and burnt bricks. Bricks which are unburnt can be reburnt in the burn to follow.

The colour of the bricks will indicate to what extent the brick has been burnt. If there is doubt as to its durability, the brick could be left immersed in water and if unsatisfactory, fretting will occur. Well burnt bricks when knocked out against the other will give a metalic ring where as unburnt bricks will sound hollow or unsound.

APPENDIX 'A'





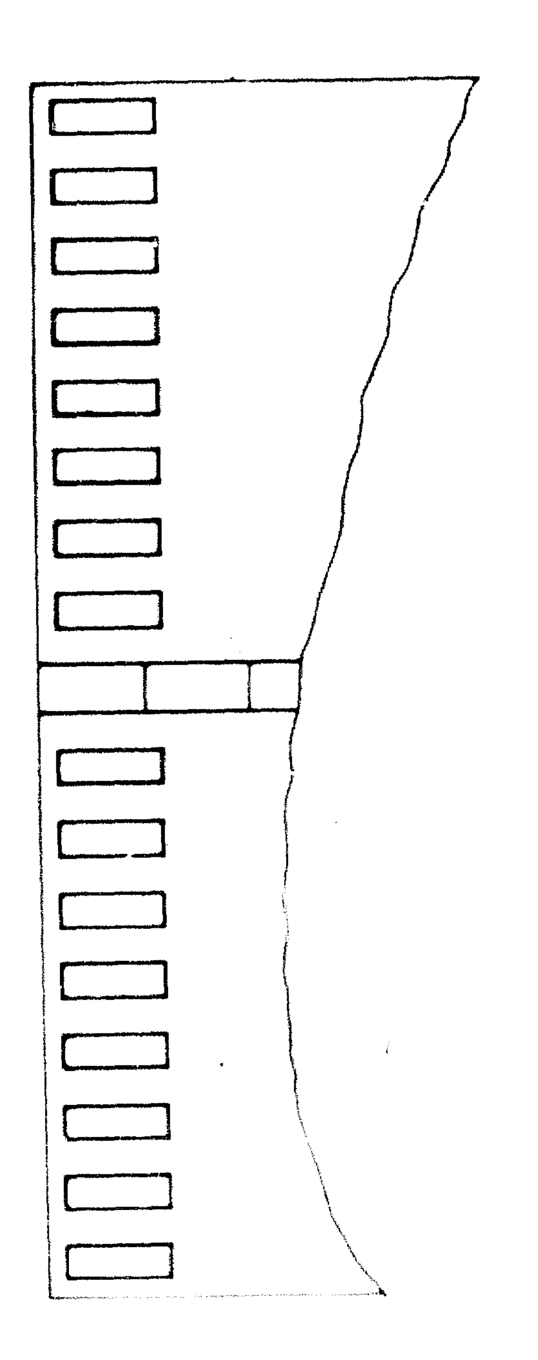
11' 1"
APPENDIX 'B' PLAN.
2' 3"
1' 0"
2' 1"
1' 0"
2' 1"
1' 0"
2' 3"
11' 8"
4' 0"
3' 1"
4' 0"

APPENDIX 'b' ELEVATION KILN

APPENDIX 'C'

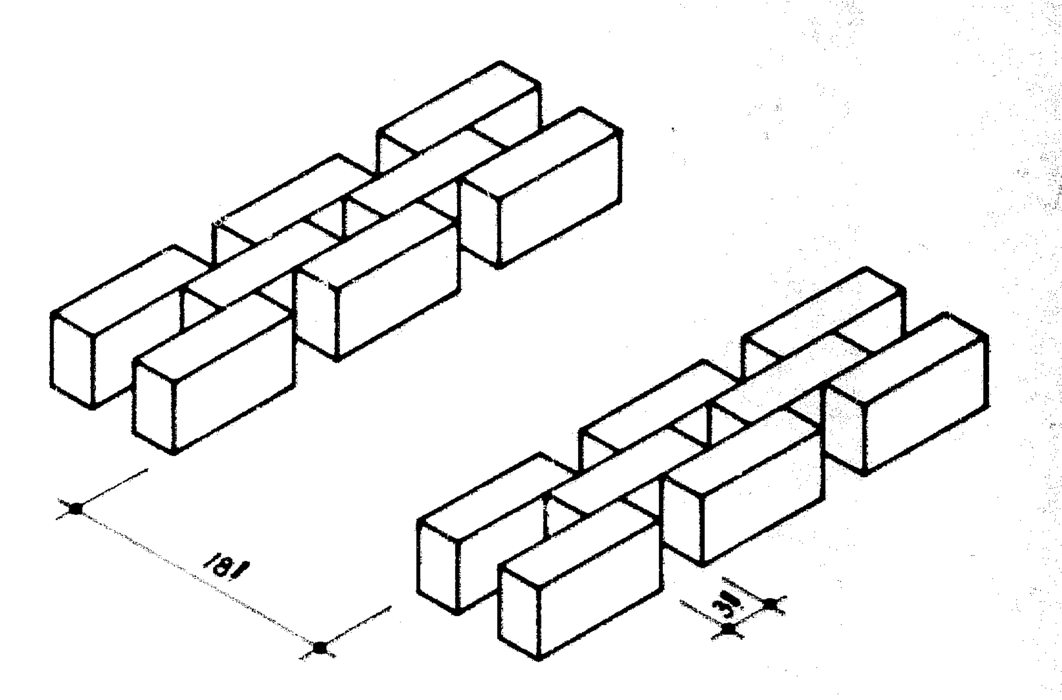
COURSES 1-2-4.

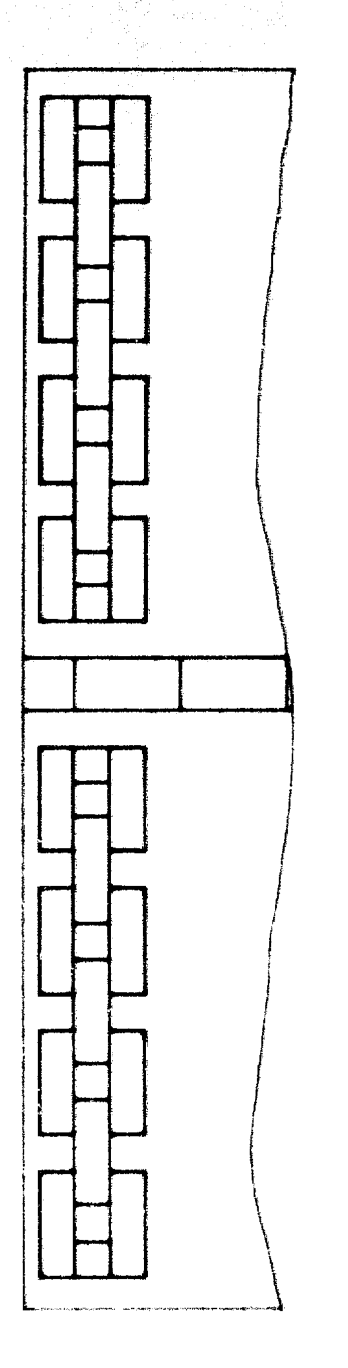
1.



1-2-4

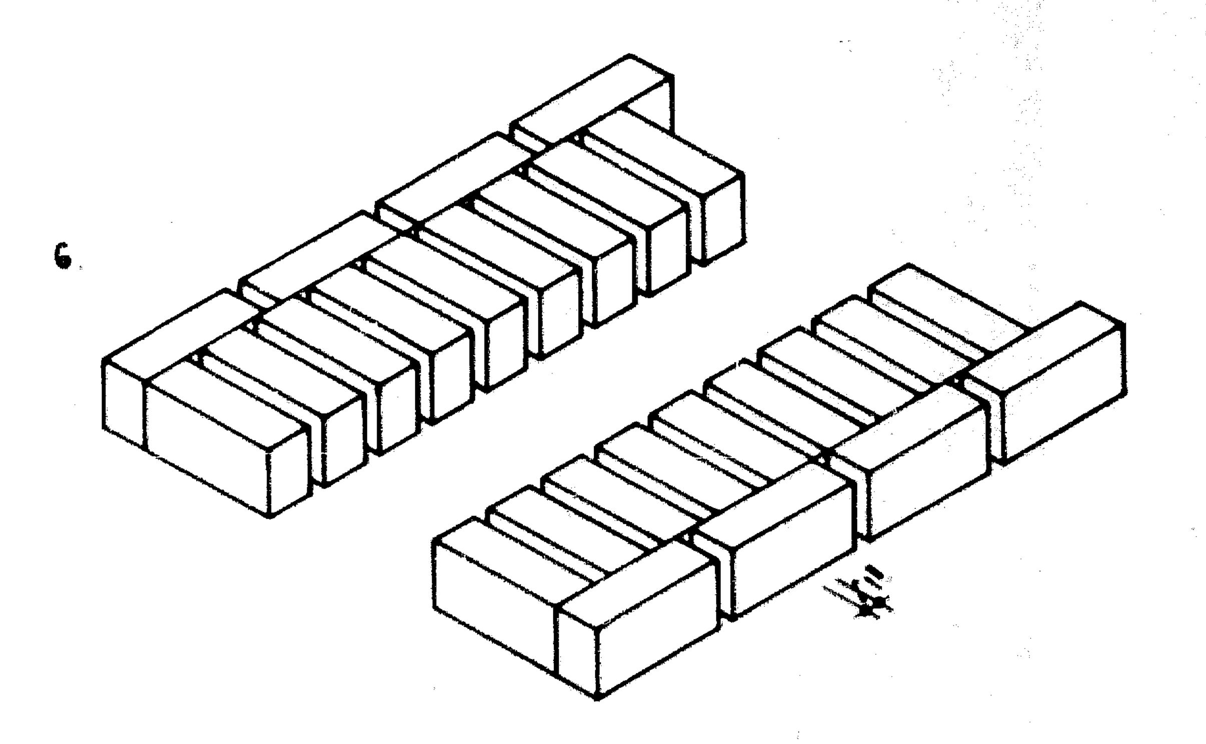
APPENDIX 'C'
COURSES 3 AND 5

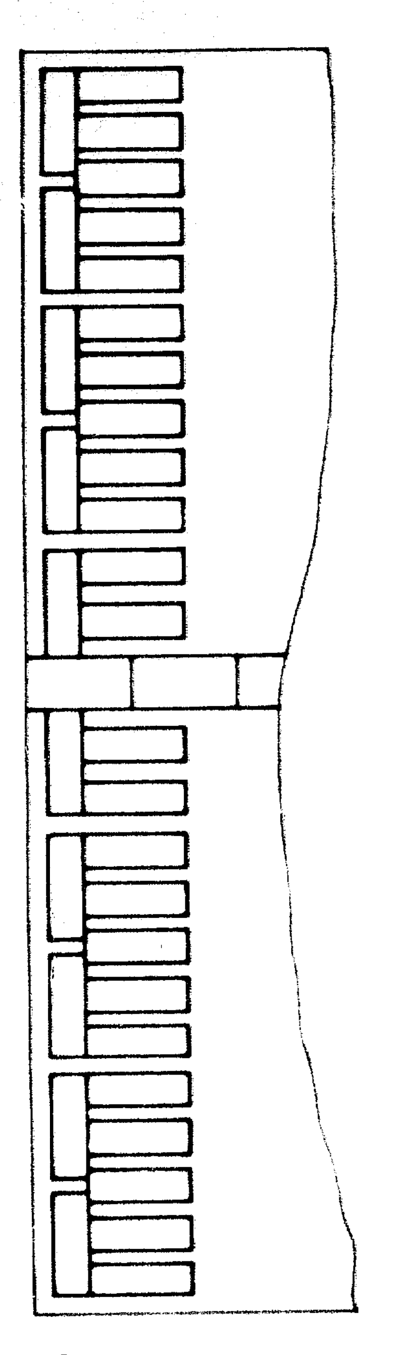




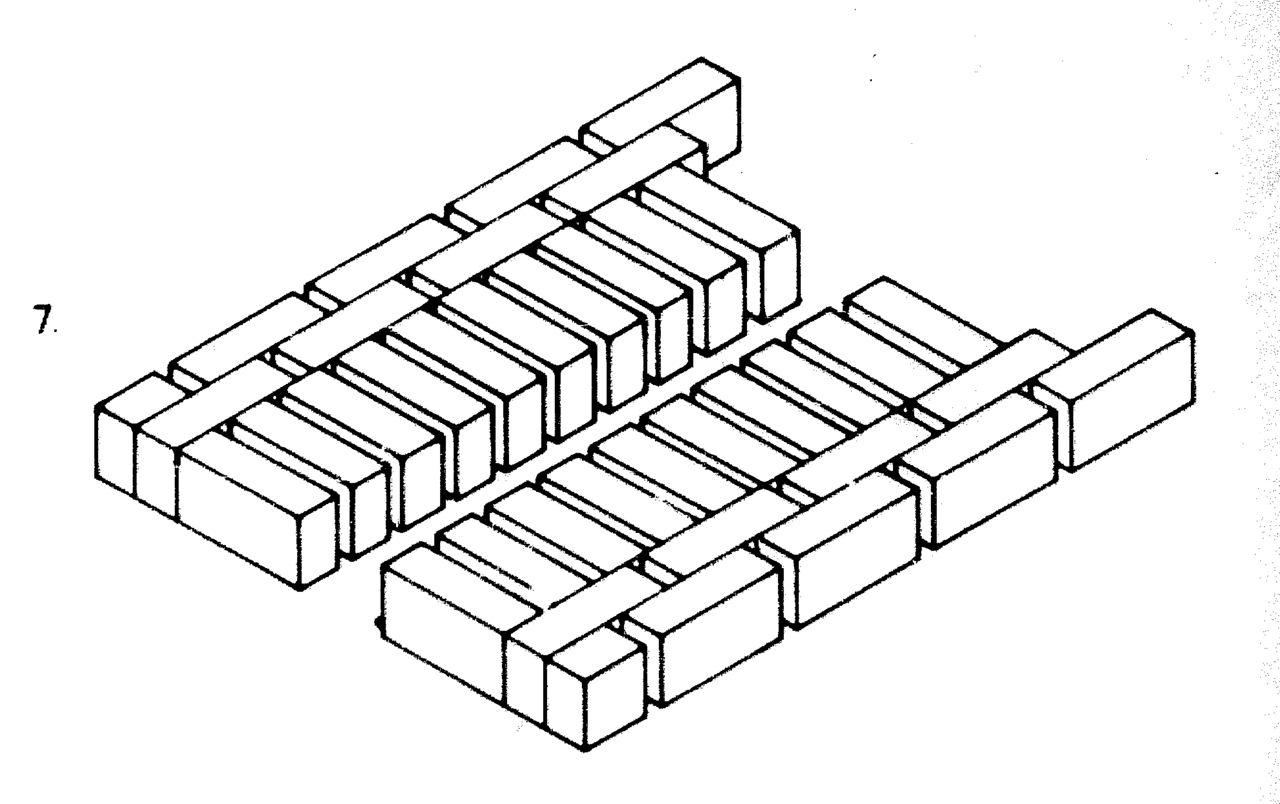
3-5

APPENDIX 'C'
COURSE 6.

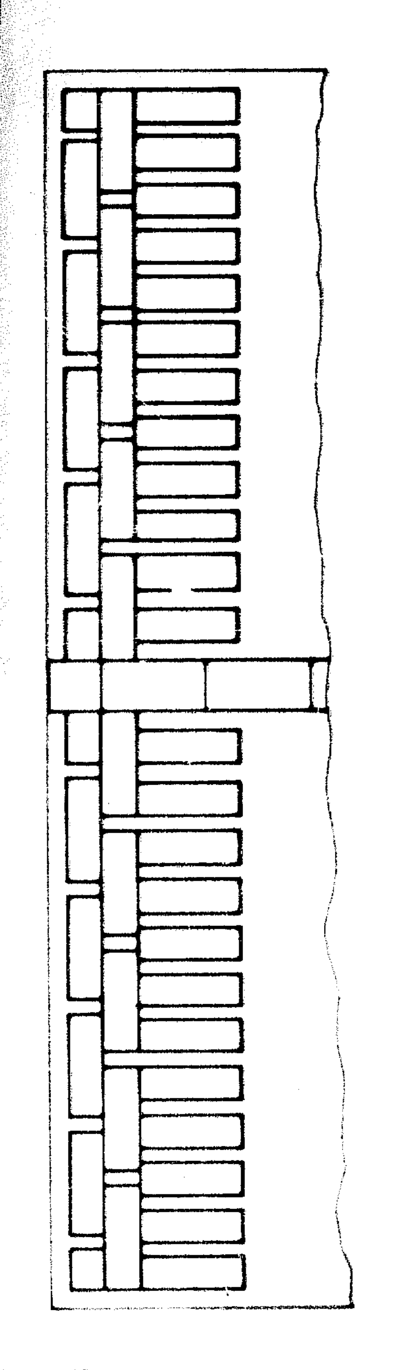




APPENDIX 'C'
COURSE 7.



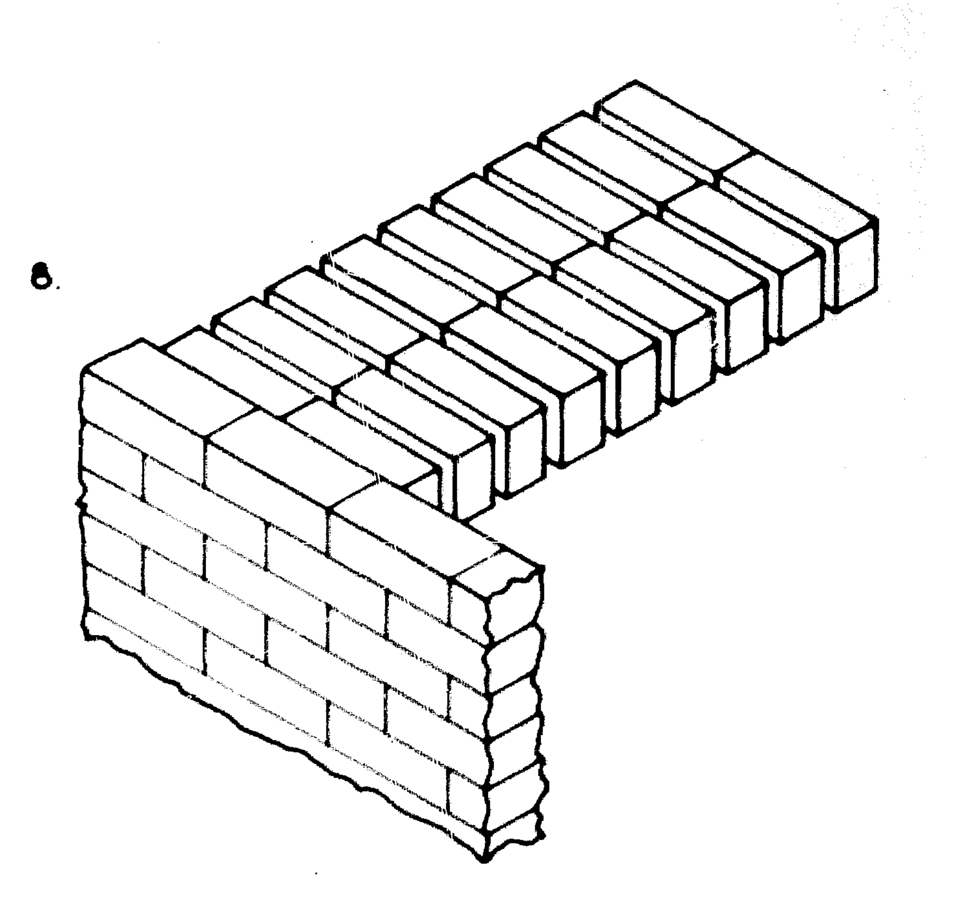
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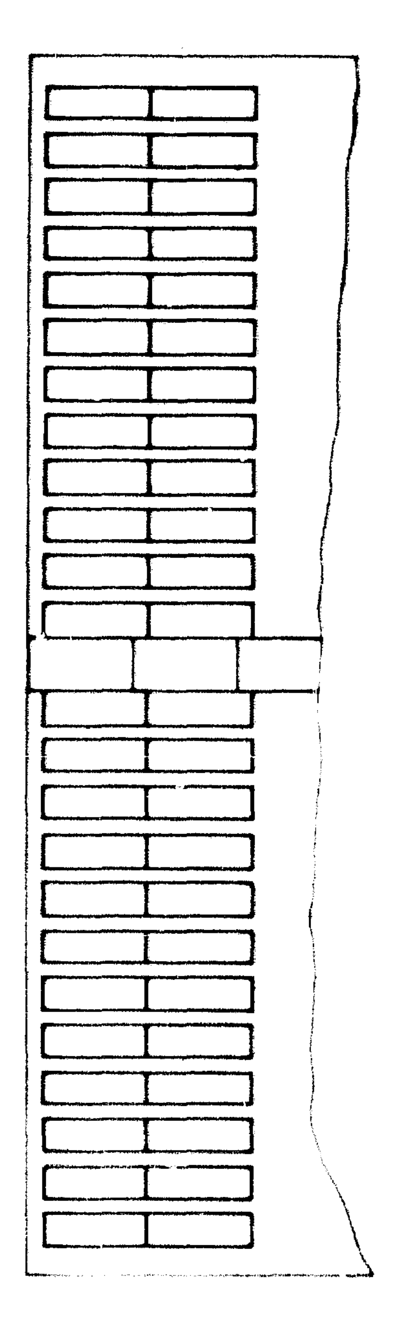


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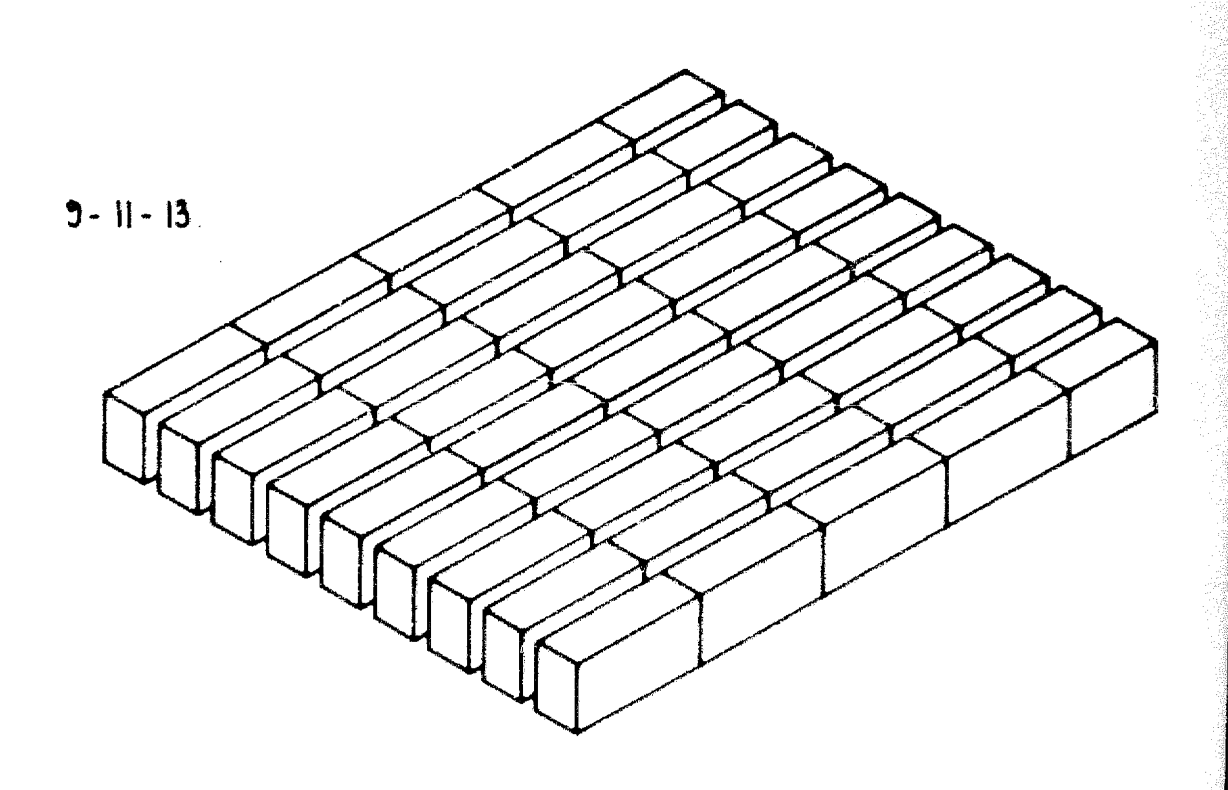
APPENDIX 'C'

COURSE 8 & Height of bagwall.

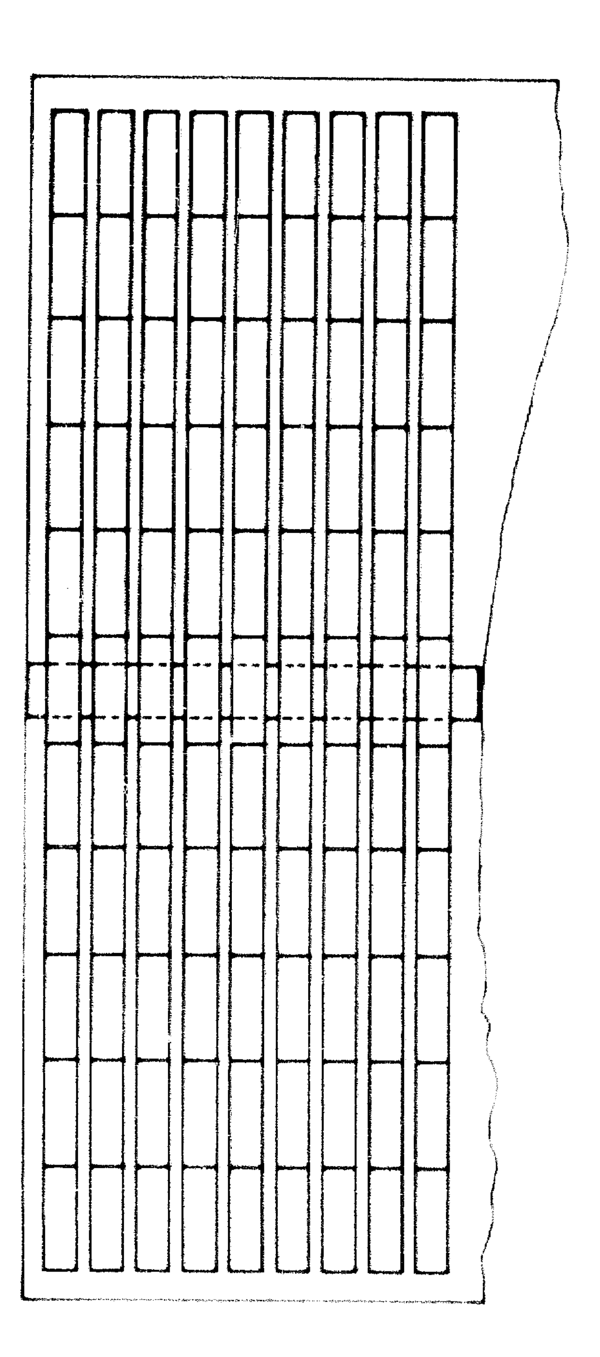




APPENDIX 'C'
COURSES 9 - 11 - 13.

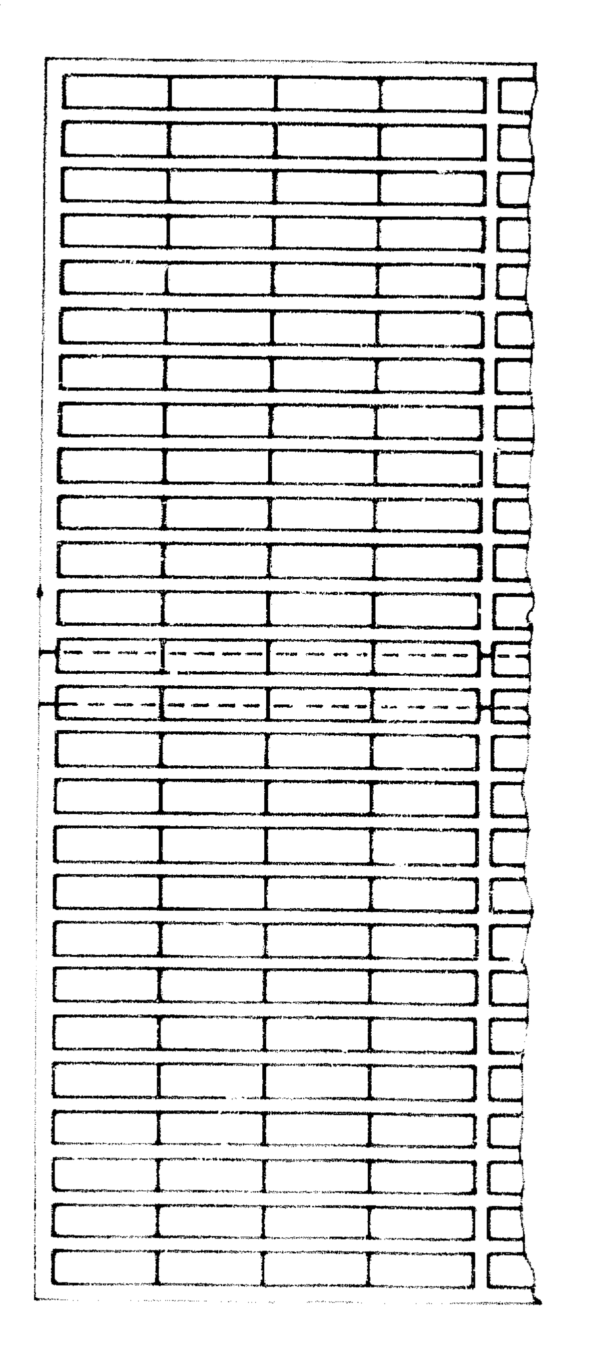


9 - 11 - 13.

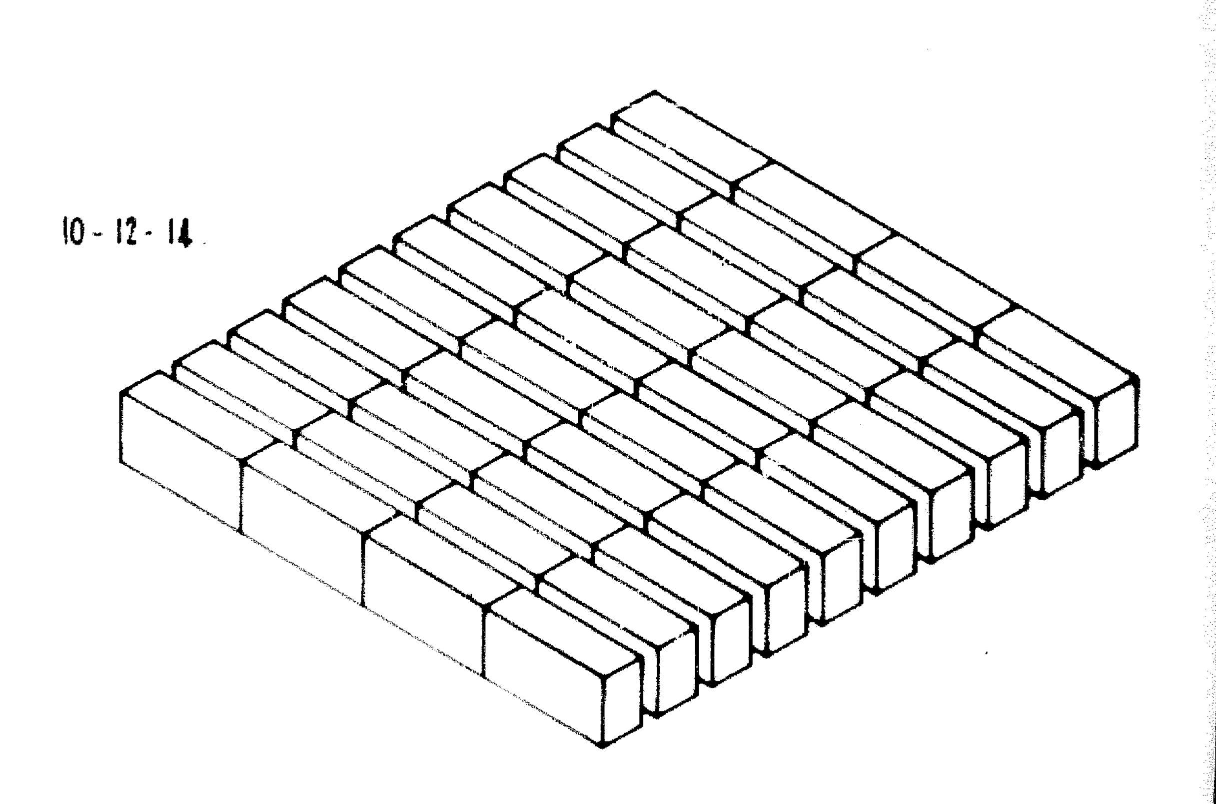


9 - 11 - 13.

APPENDIX 'C'
COURSES 10 - 12 - 14.

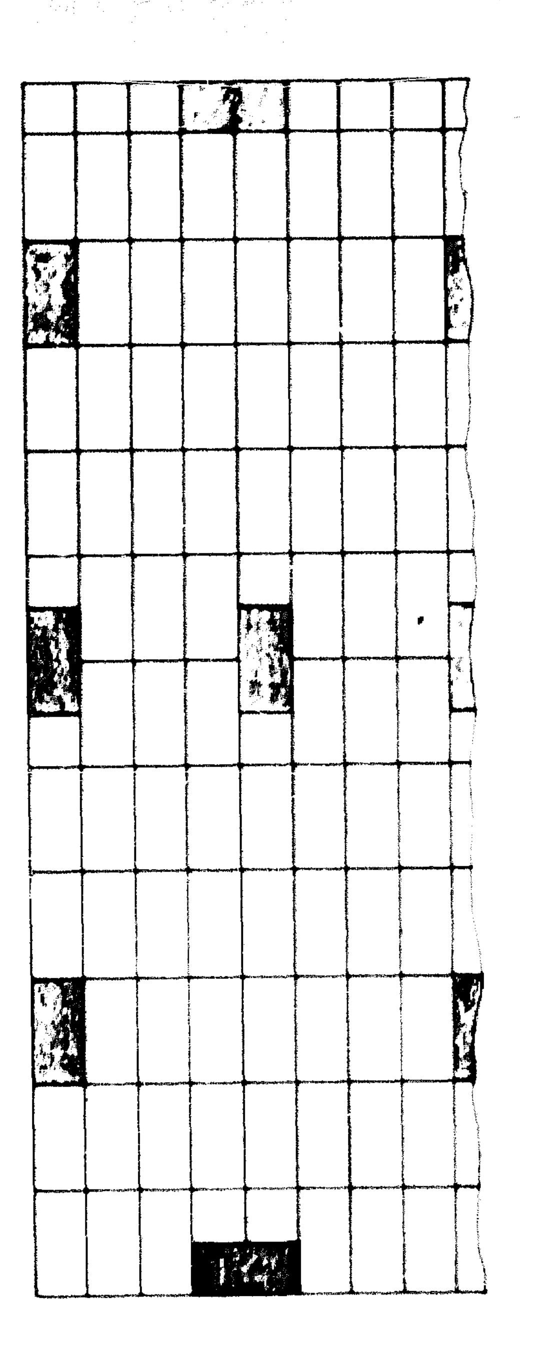


10 - 12 - 14.

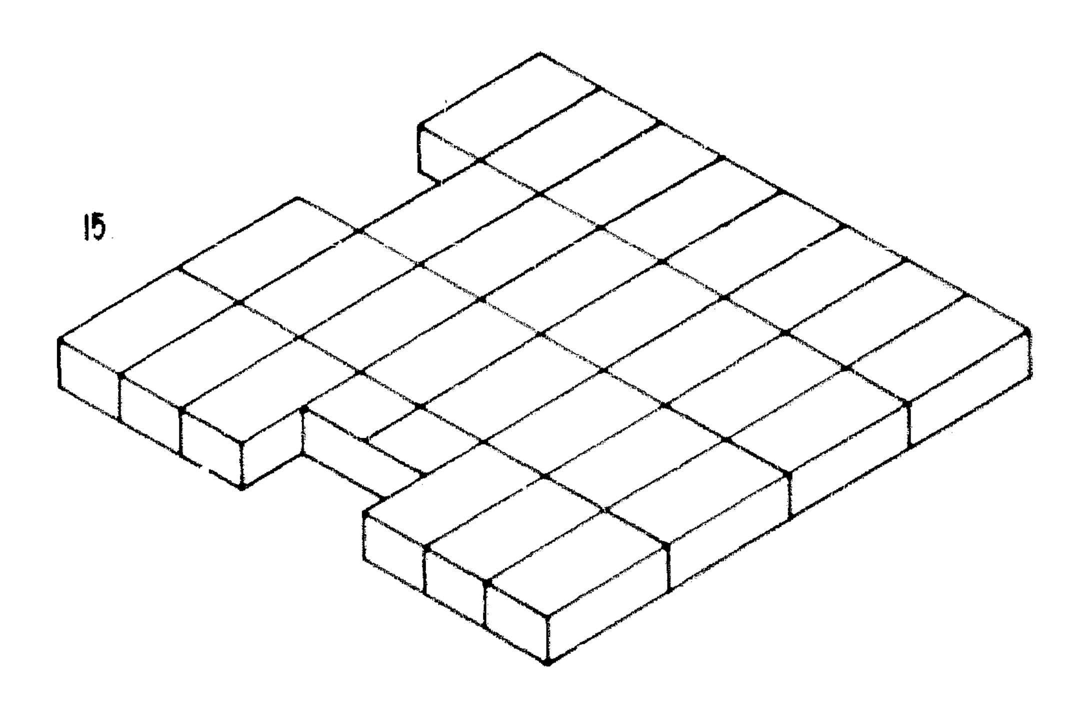


10 - 12 - 14.

APPENDIX 'C'
COURSE 15

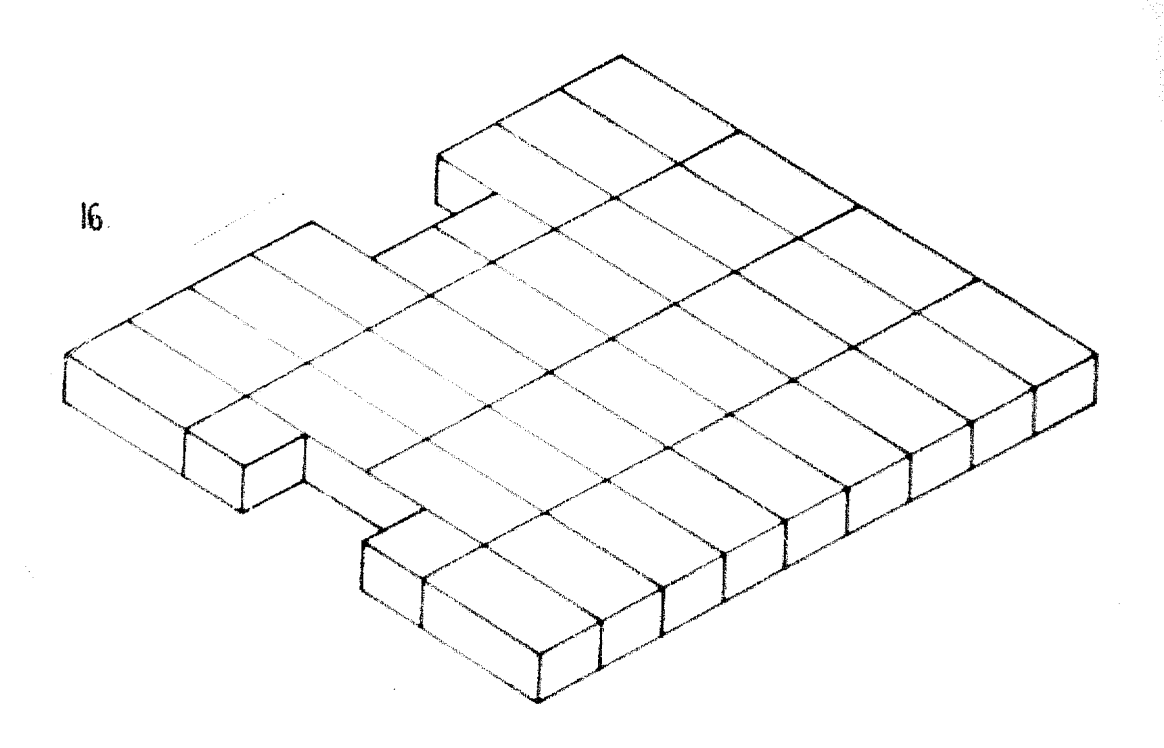


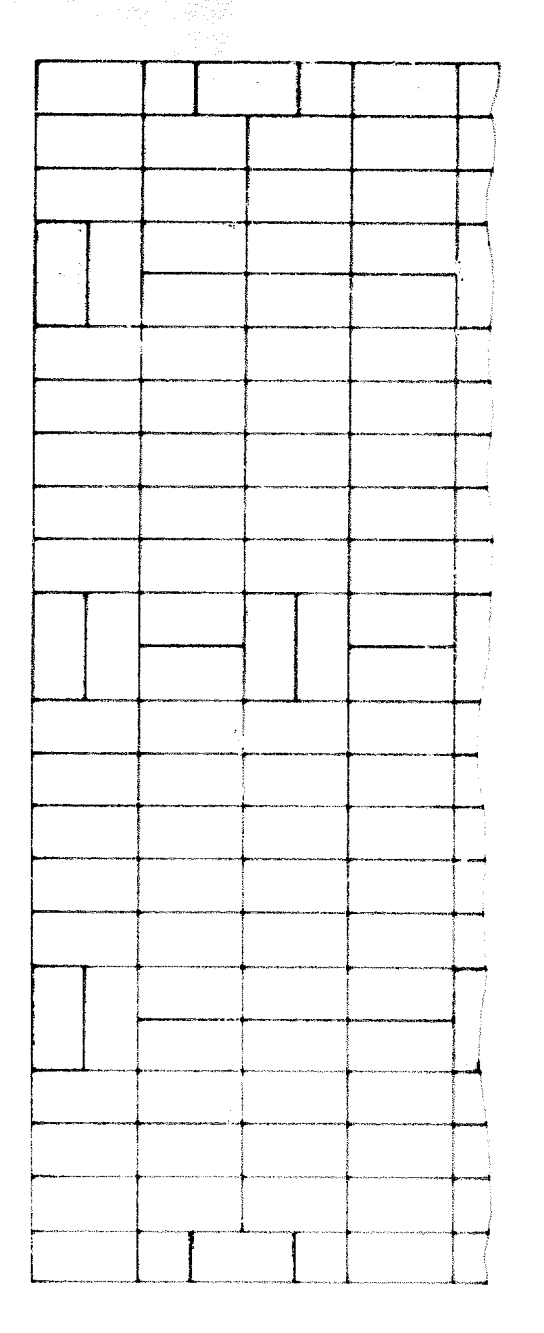
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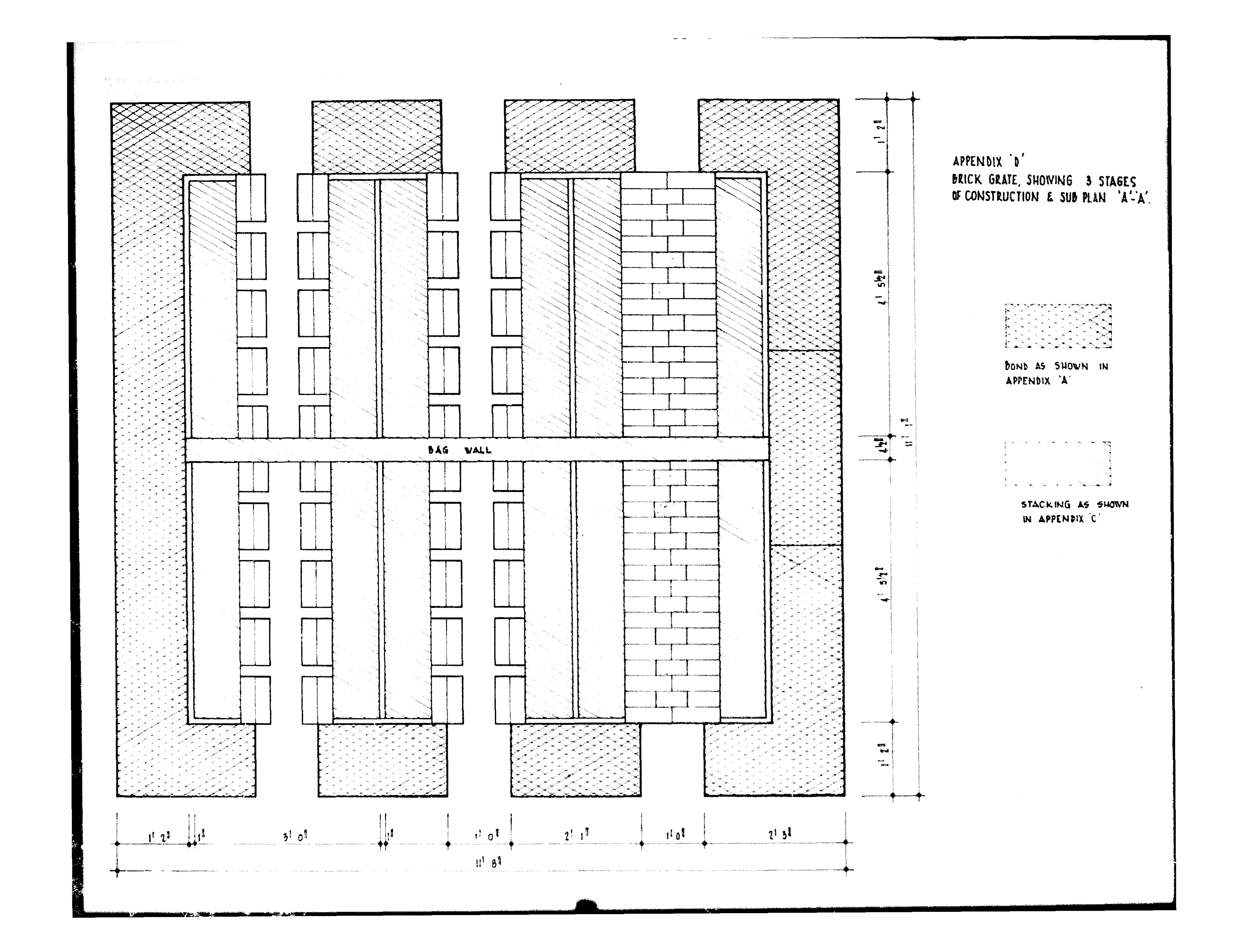


15

Port Moresby G. Dash Acting Government Printer—[illegible]


16.


16.



APPENDIX 'D'
BRICK GRATE, SHOWING 3 STAGES OF CONSTRUCTION & SUB PLAN 'A'-'A'.
BAG WALL
BOND AS SHOWN IN APPENDIX 'A'
STACKING AS SHOWN IN APPENDIX 'C'
1' 2"
4' 5½"
4½"
4' 5½"
1' 2"
11' 1"
1' 2"
1"
3' 0"
1"
1' 0"
2' 1"
1' 0"
2' 3"
11' 8"

APPENDIX 'D'
BRICK GRATE

